REMARKS

This application has been revised in light of the Office Action mailed February 5, 2003. Claims 1-9 and 15-20 are presented for examination. Claims 10-14 have been canceled. Claims 1, 15 and 16 have been amended. New Claims 17-20 have been added.

The claim amendments and new claims presented herein are fully supported by the specification and drawings as originally filed. Specifically, the amendments to Claims 1, 15 and 16 are supported by the specification at page 11, lines 21-22 and page 12, line 14. New Claim 17 is also supported at page 11, lines 21-22 to page 12, line 14. New Claim 18 is supported at page 11, line 21 to page 12, line 22, and by original Claim 16. New Claim 19 is supported by original Claim 16. New Claim 20 is supported by Figure 1. No new matter has been added.

Applicants note with appreciation the statement in the Office Action that Claim 16 would be allowable if rewritten to include all of the limitations of the base claim and any intervening claims. Claim 16 has been rewritten in independent form and now includes all of the limitations of base Claim 15. Applicants therefore submit that Claim 16 is now in condition for allowance.

Restriction Requirement

Restriction to one of the following groups of claims is required: (I) Claims 1-9 and 15-16, drawn to a multideposition SACVD reactor and a susceptor for dielectric material deposition in a SACVD reactor; and (II) Claims 10-14, drawn to a method of in-situ conditioning a carbon susceptor in a AME Centura reactor.

Applicants hereby confirm the provisional election of Group I, Claims 1-9 and 15-16. Claims 10-14 have been canceled.

Objection to Claim 16

Claim 16 is objected to for the following reason: insufficient antecedent basis was found for the limitation "said bottom polysilicon coating" and "said top polysilicon coating."

Received from < 845 892 6363 > at 5/5/03 2:17:14 PM [Eastern Daylight Time]

Claim 16 has been amended in accordance with the Examiner's suggestion. Applicants therefore submit that this objection to Claim 16 has been overcome.

Rejection of Claims 1-9 under 35 U.S.C. § 103(a) over Gallagher in view of Hayes et al.

Claims 1-9 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Applicant's admitted prior art in view of U.S. Patent No. 6,071,353 to Gallagher and in view of U.S. Patent No. 4,795,880 to Hayes et al. Applicants respectfully traverse this rejection.

Claim 1 is directed to a multideposition SACVD reactor. The reactor comprises a carbon susceptor adapted to hold a substrate in the processing chamber during a SACVD operation, wherein said carbon susceptor is coated by a polysilicon film to protect it against cleaning gases. It is a feature of the present invention that the polysilicon coating comprises a bottom polysilicon coating and a top polysilicon coating. Applicants respectfully submit that this feature (at least) is neither disclosed nor suggested by the admitted prior art in view of Gallagher and Hayes et al. for the following reasons.

The Gallagher patent is directed to the problem referred to as "buildup" which is known to be a significant source of contamination during wafer processing and thus is a serious yield detractor (col. 1, lines 21-26). For instance, when silicon nitride is deposited by chemical vapor deposition (CVD) on a wafer placed on a susceptor, silicon nitride is also deposited on the chamber inner wall forming the so-called buildup. After a certain number of runs, the buildup will flake off causing particulate contamination on the wafer. This buildup therefore must be removed during a cleaning step, "because it is desirable to keep the substrates as free of particulates and contaminants as possible during processing" (col. 1, lines 27-30). Unfortunately, etchants that are commonly used to remove the buildup, e.g. NF_3 when the buildup is silicon nitride, also attack the susceptor which is generally made of carbon (col. 1, lines 34-37; see also p. 11, lines 3-5), so that after a certain number of cleaning steps, the surface of the susceptor is significantly degraded (see Fig. 2B).

To address the problem of eliminating buildup without damaging the susceptor, Gallagher discloses coating in-situ the susceptor top surface with a thin film of polysilicon (see Fig. 3A). During buildup elimination, a portion of the polysilicon film is also removed (Fig. 3B).

Received from < 845 892 6363 > at 5/5/03 2:17:14 PM [Eastern Daylight Time]

Finally, the remaining polysilicon is in-situ stripped off (Fig. 3C) leaving the susceptor ready for the processing of the next wafers.

Gallagher, however, fails to disclose or even suggest a bottom polysilicon coating on the susceptor. In fact, Gallagher fails to appreciate the need for protection of the bottom surface of the susceptor. Figure 1 of Gallagher shows the etchant gas flowing only above the susceptor top surface, but some gas is also flowing in the lower volume of the chamber through the gap that is clearly shown between the susceptor periphery and the chamber frame. As a result, even if the susceptor top surface appears to be well protected from aggressive etchants, the susceptor bottom surface is not protected and will degrade as the number of runs increases, reducing thereby the susceptor lifetime. Gallagher therefore fails to provide motivation to modify the admitted prior art to include a bottom polysilicon coating as well as a top polysilicon coating.

In addition to protecting the bottom surface of the susceptor from damaging etchant gases, the bottom polysilicon coating provides another important advantage. In conventional SACVD reactors such as that of Gallagher, the wafer is placed on the polysilicon coated susceptor, but the temperature of the wafer is determined from the temperature of the carbon susceptor. In Figure 1 of Gallagher, the temperature measurement is clearly performed by the optic pyrometer which aims at the susceptor lower face. The temperature which is measured is based on the emissivity of carbon and not of the polysilicon that supports the wafer in reality. In the multideposition SACVD reactor of the present invention, it is the emissivity of the polysilicon bottom coating that will be used to determine the temperature of the wafer which is supported by the polysilicon coating on the upper face of the susceptor. Clearly, the accuracy of wafer temperature determination is significantly improved with the presence of the polysilicon bottom coating. Gallagher fails to appreciate this additional advantage of the polysilicon bottom coating.

Hayes et al. fail to remedy the deficiencies of the Gallagher disclosure in this regard. The Hayes et al. patent is directed to a plasma cleaning apparatus for a low pressure chemical vapor deposition (LPCVD) system. Hayes et al. recognize the problem of buildup of films formed by LPCVD (col. 1, lines 16-27); however, their solution involves only in-situ

Received from < 845 892 6363 > at 5/5/03 2:17:14 PM [Eastern Daylight Time]

cleaning by application of an etchant plasma gas (col. 2, lines 17-21). Hayes et al. fail to address the problem of etchant gases, especially NF_3, attacking the carbon susceptor. Hayes et al. therefore fail to provide any motivation to coat the carbon susceptor with polysilicon, either on the top or bottom.

Accordingly, Applicants respectfully submit that Claim 1 is patentable over the admitted prior art in view of Gallagher and Hayes et al. Claims 2-9, which include all of the limitations of Claim 1, are also patentable over the admitted prior art in view of Gallagher and Hayes et al. Applicants therefore request withdrawal of this rejection.

Rejection of Claim 15 under 35 U.S.C. § 103(a) over Gallagher

Claim 15 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Applicant's admitted prior art in view of U.S. Patent No. 6,071,353 to Gallagher. Applicants respectfully traverse this rejection.

Claim 15 is directed to a susceptor for dielectric and non-dielectric material deposition in a SACVD reactor resistant to NF_3 attack. The susceptor comprises a carbon plate coated by a polysilicon film. It is a feature of the present invention that the polysilicon coating comprises a bottom polysilicon coating and a top polysilicon coating. Applicants respectfully submit that this feature (at least) is neither disclosed nor suggested by the admitted prior art in view of Gallagher for the following reasons.

As discussed previously, the Gallagher patent is directed to the problem referred to as "buildup." Etchants that are commonly used to remove the buildup, e.g. NF_3 when the buildup is silicon nitride, also attack the susceptor which is generally made of carbon, so that after a certain number of cleaning steps, the surface of the susceptor is significantly degraded. To address the problem of eliminating buildup without damaging the susceptor, Gallagher discloses coating in-situ the susceptor top surface with a thin film of polysilicon.

Gallagher, however, fails to disclose or even suggest a bottom polysilicon coating on the susceptor. In fact, Gallagher fails to appreciate the need for protection of the bottom surface of the susceptor. Figure 1 of Gallagher shows the etchant gas flowing only above the susceptor top surface, but some gas is also flowing in the lower volume of the chamber through

Received from < 845 892 6363 > at 5/5/03 2:17:14 PM [Eastern Daylight Time]

the gap that is clearly shown between the susceptor periphery and the chamber frame. As a result, even if the susceptor top surface appears to be well protected from aggressive etchants, the susceptor bottom surface is not protected and will degrade as the number of runs increases, reducing thereby the susceptor lifetime. Gallagher therefore fails to provide motivation to modify the admitted prior art to include a bottom polysilicon coating as well as a top polysilicon coating.

In addition to protecting the bottom surface of the susceptor from damaging etchant gases, the bottom polysilicon coating also allows for more accurate wafer temperature determination. In conventional SACVD reactors such as that of Gallagher, the wafer is placed on the polysilicon coated susceptor, but the temperature of the wafer is determined from the temperature of the carbon susceptor. In Figure 1 of Gallagher, the temperature measurement is clearly performed by the optic pyrometer which aims at the susceptor lower face. The temperature which is measured is based on the emissivity of carbon and not of the polysilicon that supports the wafer in reality. With the susceptor of the present invention, it is the emissivity of the polysilicon bottom coating that will be used to determine the temperature of the wafer which is supported by the polysilicon coating on the upper face of the susceptor. Clearly, the accuracy of wafer temperature determination is significantly improved with the presence of the polysilicon bottom coating. Gallagher fails to appreciate this additional advantage of the polysilicon bottom coating, and therefore fails to provide motivation to modify the admitted prior art in this regard.

Accordingly, Applicants respectfully submit that Claim 15 is patentable over the admitted prior art in view of Gallagher and Hayes et al. Applicants therefore request withdrawal of this rejection.

Conclusion

Applicants have properly traversed each of the grounds for rejection in the Office Action, and therefore respectfully submit that the present application is now in condition for allowance. If the Examiner has any questions or believes further discussion will aid examination and advance prosecution of the application, a telephone call to the undersigned is invited.

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No fee is believed to be due for the submission of this Amendment. However, if any fees are required, the Commissioner is authorized to charge such fees to Deposit Account No. 09-0458.

Respectfully submitted,

Margaret A. Pepper

Margaret A. Pepper
Attorney for Applicant
Registration No. 45,008
Tel. (845) 894-4713

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Received from < 845 892 6363 > at 5/5/03 2:17:14 PM [Eastern Daylight Time]